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I - 2 Collection of *Vigna riukiuensis* and *V. reflexo-pilosa*, Wild Relatives of Adzuki Bean on Iriomote Island, Okinawa Prefecture

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Introduction

Subgenus *Ceratotropis* of the genus *Vigna* is considered to have originated in Asia. This subgenus which consists of sixteen species forms a morphologically homogeneous group (BAUDOIN and MARÉCHAL 1988). The cultigens belonging to *Ceratotropis* such as adzuki bean, mungbean, and so on are used in various forms as food mainly in the Asian countries. However, the wild relatives have not been sufficiently documented so far. Four wild species described below occur naturally in Japan.

V. angularis var. *nipponensis*, which is considered to be a progenitor of adzuki bean (var. *angularis*), grows in Japan, Korea, Taiwan, North China and the Himalayas. *V. nakashimae* (OHWI) OHWI and OHASHI is distributed in Korea, North China and the northern part of Kyushu island in Japan. The distribution of *V. riukiuensis* (OHWI) OHWI and OHASHI is restricted to both the Ryukyu Islands and Taiwan. This species is closely related morphologically to *V. minima* which is distributed from South China to the Southeast Asian countries. TATEISHI (1984) designated *V. riukiuensis* as *V. minima* var. *minor* (MATSUM.) TATEISHI. *V. reflexo-pilosa* HAYATA is widely distributed from South China to Thailand, and also occurs in the Ryukyu Islands and Taiwan. *V. angularis* var. *nipponensis*, *V. nakashimae* and *V. riukiuensis* are diploid species (2n=22) while *V. reflexo-pilosa* is a tetraploid species (2n=44).

The main objective of the present exploration was to collect *V. riukiuensis* and *V. reflexo-pilosa* seeds on Iriomote Island, Okinawa Prefecture for use as breeding materials for the adzuki bean improvement program.

Method

V. riukiuensis and *V. reflexo-pilosa* were collected along roadsides on Iriomote Island, Okinawa Prefecture according to the itinerary indicated in Table 1. These wild species exhibit the following morphological features ; yellow flower with a pocket on keel petal, incurved keel petal, style beak, peltate stipule (TATEISHI 1984 ; TATEISHI and OHASHI in press). In the areas where we found trifoliate plants or yellow flowers, we observed the leaf and flower morphology to identify the species. Then the seeds were collected if mature pods had set. When we found a number of individuals in the same site, we collected seeds at intervals of approximately 10 m.

Table 1. Itinerary of the exploration for *Vigna riukiuensis* and *V. reflexo-pilosa* on Iriomote Island, Okinawa Prefecture

Date	Itinerary	Notes
15 Nov.	Iriomote Island Ohara ----- Funaura - - - Uehara - - Nakano - - - Urauchi - - - Hoshidate - - - Sonai (Lodging)	A total of 11 accessions were collected.
16 Nov.	Sonai - - - Midara ----- Funaura - - - Akabanari - - - Takana - - - Nubaru - - - Mihara ----- Ohara	A total of 24 accessions were collected.

---- Bus transportation
- - - Walk

Results

We collected a total of 35 accessions including four *Vigna* species ; 25 accessions of *V. riukiuensis*, 6 of *V. reflexo-pilosa*, 2 of *V. marina* and 2 of *V. unguiculata*. *V. reflexo-pilosa* did not occur as frequently along the roadsides as *V. riukiuensis*. The collection sites on Iriomote Island are indicated in Fig. 1. Details on the collection of each species are shown in Table 2.

The area between Nubaruzaki and Mihara, especially the area near the Yonara bridge, was a good collection site. We found a large number of plants of *V. riukiuensis* and *V. reflexo-pilosa* which occurred widely at the edge of pastures along the roadside and were intermingled. We collected a total of 12 accessions of *V. riukiuensis* and 5 of *V. reflexo-pilosa* around this area as shown in Table 2. In contrast, between Nubaruzaki and Funaura we found *V. riukiuensis*

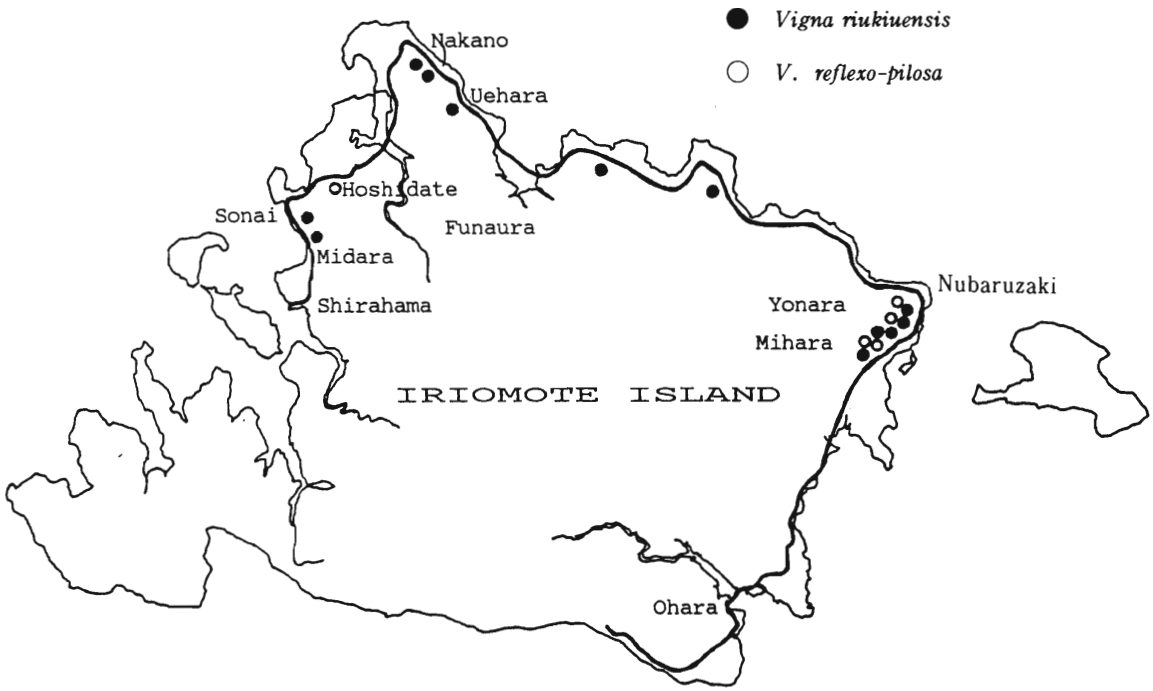

Fig. 1. The exploration route in Iriomote Island.

Table 2. Number of accessions of *Vigna* species collected on Iriomote Island, Okinawa Prefecture

Date	Locality	*riukiuensis*	*reflexo-pilosa*	*marina*	*unguiculata*	*Total*
15 Nov.	Uehara	1	-	1	-	2
	Nakano	5	-	1	-	6
	Urauchi	1	-	-	1	2
	Hoshidate	-	1	-	-	1
16 Nov.	Sonai	2	-	-	1	3
	Funaura	2	-	-	-	2
	Akabanari	1	-	-	-	1
	Takana	1	-	-	-	1
	Nubaru	11	2	-	-	13
	Mihara	1	3	-	-	4
	total	25	6	2	2	35

individuals at the young vegetative stage only sporadically. In the Nakano area (near the bus stop) we were able to observe a large number of individuals of *V. riukiuensis* on the sunny ground. We collected 5 accessions there.

A large population of *V. reflexo-pilosa* was found at the site located 1 km east from Hoshidate. The habitat of this population was a wasteland at the edge of a forest and the plants were twining on grasses. We collected many seeds of *V. reflexo-pilosa* at this site. During the exploration of the Sonai area, we observed many individuals of *V. riukiuensis* occurring on open ground along the roadside by the seashore. We obtained 4 accessions of *V. riukiuensis* at this site.

Discussion

Exploration of wild relatives is often a time-consuming and difficult task and there is little or no information about potentially useful characteristics which the wild species harbour. Wild species generally exhibit a wide range of genetic diversity in terms of agronomic characteristics such as pest and disease resistance, rapid growth, environmental adaptation, resistance to lodging, vigorous root system and high-yielding potential (PRESCOTT-ALLEN and PRESCOTT-ALLEN 1988). Thus wild germplasm is essential as breeding material especially for resistance to pests and diseases (FUJII and MIYAZAKI 1987, KITAMURA et al. 1988).

V. riukiuensis is cross-compatible with adzuki bean, var. *nipponensis*, rice bean (*V. umbellata*) and *V. nakashimae* when crossed as a pollen parent (SIRIWARDHANE et al. in preparation). TOMOOKA (unpublished data) observed that *V. riukiuensis* shows a high level of resistance to the infestation with bean weevils, *Callosobruchus chinensis* and *C. masculatus*. *V. riukiuensis* thus can be the donor of valuable genes to adzuki bean. Collected samples will be planted for evaluating morphological and agronomic characteristics to promote an adzuki bean improvement program through interspecific hybridization.

V. reflexo-pilosa is a tetraploid ($2n=44$) species and 22 bivalents are normally formed during the meiosis (Tables 3 and 4). Therefore, this species is considered to have originated as an amphidiploid. *V. reflexo-pilosa* is cross-compatible with *V. glabrescens* MARECHAL, MASCHERPA & STAINER which is also an amphidiploid ($2n=4x=44$) (SWINDELL et al. 1973). They readily produced hybrid seeds when crossed with each other. Judging from the morphological similarities of seed and primary leaves, the same ploidy level (4x) and high cross-compatibility between them, it is concluded that *V. reflexo-pilosa* is closely related to *V. glabrescens*. *V. glabrescens* exhibits pest and disease resistance and is included in the mungbean improvement program at AVRDC (EGAWA et al. 1988 ; FERNANDEZ and SHANMUGASUNDARUM 1988). It is anticipated that *V. reflexo-pilosa* harbours valuable characteristics similar to those of *V. glabrescens*. Cross-compatibility between *V. reflexo-pilosa* and diploid *Vigna* species needs to be analysed to use this species effectively as a breeding material.

Table 3. Average frequency of chromosome pairing at MI in *Vigna reflexo-pilosa*

No. of cells observed	Chromosome pairing			
	univalent	bivalent		
		ring	rod	total
46	0.1	12.8	9.1	21.9

Table 4. Chromosome configuration at MI in *Vigna reflexo-pilosa*

Chromosome configuration		No. of cells observed
uni-	bi-valent	
	22	44 (95.7%)
2	21	2 (4.3%)
	Total	46

Wild germplasm is now confronted with gradual extinction due to the recent widespread land clearance for construction of buildings, railways and roads. It is very important to pay attention to the collection and preservation of these materials before extinction. The present exploration was conducted only on Iriomote Island. If we could expand the exploration area to Hateruma, Tarama, Miyako and Yonaguni Islands in the future, more contribution to the collections of *V. riukiuensis* and *V. reflexo-pilosa* could be achieved.

We frequently found *V. marina* spreading on sandy ground over large areas near the seashore. Cowpea plants, *V. unguiculata*, which occurred sporadically along the roadsides, are assumed to have escaped from cultivation. We collected 2 accessions of *V. marina* and 2 of *V. unguiculata* during the exploration. *V. marina* and *V. unguiculata* belong to the subgenus, *Vigna*. Interspecific relationships between these two species and between the subgenera *Vigna* and *Ceratotropis* have been poorly documented so far (FARIS 1965).

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沖縄県西表島におけるアズキ近縁野生種 *Vigna riukiuensis*, *V. reflexo-pilosa* の探索収集

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要　約

Vigna 属のアズキ亜属（*Ceratotropis*）は，アジアに起原したと考えられている。本亜属はアズキ，リョクトウ等の重要な栽培種を含んでいるが，それらの近縁野生種は殆ど研究されておらず，組織的な探索収集はなされていない。本研究ではアズキ近縁野生種，*V. riukiuensis*（ヒナアズキ）と *V. reflexo-pilosa*（オオヤブツルアズキ）を沖縄県西表島の大原から白浜まで県道沿い約 40 km を徒歩により探索収集を行なった。

本探索により，25点の *V. riukiuensis* と 6 点の *V. reflexo-pilosa* を収集した。野原崎と美原の間の地域，特に与那良橋の近くで多くの自生地を見いだした。島の北側，野原崎から船浦の間では，若い栄養生長期にある *V. riukiuensis* を極くまれに見つけただけであった。中野では，開けたところに *V. riukiuensis* が群生しているのを観察した。星立の集落から約 1 km 東の地点で *V. reflexo-pilosa* の大きな集団を見いだした。祖納地域では，海岸近くの道路沿いの開けた所に *V. riukiuensis* が多く自生していた。海岸の砂浜には広い範囲にわたって *V. marina*（ハマアズキ）が自生していた。また栽培からの逸出であると思われる *V. unguiculata*（ササゲ）が道路沿いで散見された。*V. marina* 2 点と *V. unguiculata* 2 点をあわせて収集した。

アズキ近縁野生種は，耐病虫性の遺伝子の給源として重要である。*V. riukiuensis* は栽培アズキと容易に雑種を作ることから，栽培アズキへ *V. riukiuensis* からの遺伝子の導入は容易であると考える。*V. reflexo-pilosa* は，4 倍体（2n＝44）であり，減数分裂で22個の二価染色体を形成することから複二倍体であり，*V. glabrescens* と容易に雑種を作るので両種は共通のゲノムを有すると想像する。*V. glabrescens* が耐病虫性を示すことから，*V. reflexo-pilosa* も同様の遺伝子を有すると予想される。

沖縄琉球諸島のアズキ近縁野生種の自生地は，道路等の建設により今後減少することが予想される。消滅前に野生種を収集保存することは急を要する課題であり，波照間，多良間，宮古，与那国の各島で調査を継続する。